



LESSON PLAN

GENES AND MUTATIONS GRADES 6-8

SUMMARY

Students engage in an activity to figure out how a mutation is passed from parent to offspring.



MS-LS3-1. Develop and use a model to describe why structural changes to genes (mutations) located on chromosomes may affect proteins and may result in harmful, beneficial, or neutral effects to the structure and function of an organism.

MS-LS3-2. Develop and use a model to describe why asexual reproduction results in offspring with identical genetic information and sexual reproduction results in offspring with genetic variation.

Science & Engineering Practices	Connections to Classroom Activity
<p>Developing and Using Models</p>	<ul style="list-style-type: none"> • Students use a pedigree model to figure out and explain how a trait can be passed from one generation to the next. • Students develop a model in the exit ticket to explain how a trait can be changed and passed on.
Disciplinary Core Ideas	Connections to Classroom Activity
<p>LS1.B: Growth and Development of Organisms Organisms reproduce, either sexually or asexually, and transfer their genetic information to their offspring.</p> <p>LS3.A: Inheritance of Traits Genes are located in the chromosomes of cells, with each chromosome pair containing two variations of each of many distinct genes. Each distinct gene chiefly controls the production of specific proteins,</p>	<ul style="list-style-type: none"> • Students engage in using a pedigree to explain how organisms get half of their traits from a female and the other half from a male. • Students use a pedigree model to figure out and explain how genes are passed on from parent to offspring. • Students watch the Generation Genius video to learn about genes, chromosomes, and mutations.

which in turn affects the traits of the individual. Changes (mutations) to genes can result in changes to proteins, which can affect the structures and functions of the organism and thereby change traits.

Variations of inherited traits between parent and offspring arise from genetic differences that result from the sub-set of chromosomes (and therefore genes) inherited.

LS3.B: Variation of Traits

In sexually reproducing organisms, each parent contributes half of the genes acquired (at random) by the offspring. Individuals have two of each chromosome and hence two alleles of each gene, one acquired from each parent. These versions may be identical or may differ from each other.

In addition to variations that arise from sexual reproduction, genetic information can be altered because of mutations. Though rare, mutations may result in changes to the structure and function of proteins. Some changes are beneficial, others are harmful, and some are neutral to the organism.

- Students develop and model to explain how a mutated gene can be passed from one generation to the next.

Cross Cutting Concepts

Cause and Effect

Connections to Classroom Activity

- Students learn that a change in DNA can result in a trait not functioning the way it is supposed to.
- Students explain how when DNA is mutated (microscopic) it can change how the protein is made (microscopic) resulting in a change in a trait and how it functions.

DURATION

90 min.



ENGAGE

Tell students you have a short video ([Leucistic vs Wild Type Indian Peacock Joust](#)) you would like them to view. Before they watch, have them make a T-chart and label one side Notice and the other side Wonder. Tell students to write down what they notice and wonder about the two male peacocks.

Next, ask students to share observations and questions with a partner or small group. As students discuss their questions, tell them to pick out the question they most want to know to share with the class. Allow every student to ask a question. Common questions include the following:

MATERIALS

- Pedigree activity sheet

- Why is the one peacock white?
- What makes the peacock white?
- Does the white peacock have a disease?
- Why are the peacocks fighting?
- Do the different colors happen naturally in the wild?
- Was the white peacock born that way?
- Does this happen in other animals?

Tell students the white peacock is an albino and that albinism occurs in many different animals. Albinism is a genetic disorder that some organisms are born with. Albinism is a disorder that affects an animal's coloring, eyesight, and may cause an increased risk of skin cancer. NOTE: Albinism is a loss of all pigmentation, and Leucistic is a loss of some pigmentation, for this introductory activity, either word can be accepted as meaning a loss of pigmentation.

Now that students know a little more about albinism, tell students to work in small groups to come up with ideas about HOW albinism occurs. Give students a few minutes to brainstorm ideas, then have them share.

At this point, it is not important to correct misconceptions, incomplete science ideas, or differences in how albinism occurs. As students progress through the rest of the lessons, they will come to discover and develop these science concepts on their own.

State that it seems that they have different ideas about how albinism occurs. Next, tell students they will explore how albinism occurs.



EXPLORE

Tell students they are going to investigate a family. Hand out the pedigree of the family. Explain that a pedigree is a tool used to track a specific trait, in this case, albinism. Tell students the circles represent females and squares represent males. Also, let students know that the full shaded shapes represent the organisms that present for the trait they are studying. That is all the information students need to know now. At this point, students are using the pedigree to begin to look for patterns in the data.

Analyzing and Interpreting Data

This investigation will allow students to analyze data to identify how an animal population might shift. Hand out the activity sheet to each student and give them time to work independently. Next, have students transition into small working groups to share ideas and questions.

Next, have a group discussion and ask, "What patterns did you notice?" As students share, facilitate the discussion to allow others to share too, using phrases like:

- Did anyone have something similar they would like to share?
- Can anyone add on to that idea?
- Could you tell me more about what you are thinking around that idea?

As students share and come to some agreements, document their common ideas. Common ideas include:

- Lines across connecting a male and female represent those animals are together (most kids will say married or they had kids together)
- Lines going down represent offspring
- Non-shaded organisms do not have albinism
- We are not sure about the half-shaded organism, we know they don't have it because they are not shaded, but we think maybe it means their kids can get it.

Next, ask students what new questions they have.

- What do the shaded boxes really mean?
- Where does albinism come from?
- Why do some animals have it and some don't?
- What happens to make something all white when it should be colored?



EXPLAIN

Tell students they have a lot of great questions and that you will now watch a video that will help explain how and why the peacock in the video has albinism.



WATCH THE GENERATION GENIUS GENES AND MUTATIONS VIDEO AS A GROUP

After the video, have a discussion about what they learned from the video that can help them explain how animals are born with albinism. Some information from the video includes:

- Offspring get half their genes from their mom and the other half from dad.
- Genetic traits are passed on from parents to offspring.
- Some genes mutate, which means they change.
- Mutations can help, hurt, or make no change in the organism.
- DNA is genetic material that tells the body what proteins to make.
- Mutations can cause a protein to be made wrong.

Now that students have more information about genes, traits, and genetics, have students get back into groups to make a poster to create an initial explanation of how that peacock was born with albinism. When students are done making their posters, engage them in a gallery walk to give and receive feedback on their explanations. Last, give students time to revise their explanations based on the peer feedback.



ELABORATE

Tell students that using pedigrees is one way we can trace traits that are passed from parent to offspring. We use pedigrees to trace traits for all kinds of animals, including animals we have as pets. Some people breed animals together hoping they get certain traits. Breeders use a process called artificial selection to try to get organisms to look a specific way. In fact, some breeders even breed for albinism.

Now that students know more about genetics and how traits can be passed from parent to offspring, ask, “How would keeping track of traits be helpful?” Give students “think time” and then have them share their ideas. After students have shared, tell them there are many ways people use genetics and they will continue to learn more about genetics as they continue through high school.



EVALUATE

There are multiple ways to assess your students' understanding of this topic. The exit ticket is an opportunity for students to use the science ideas they built in the lesson in a new context. Alternatively, you can use the Kahoot! quiz (which provides downloadable scores at the end of the game) and/or the paper quiz. All these resources are located right below the video in the assessment section.





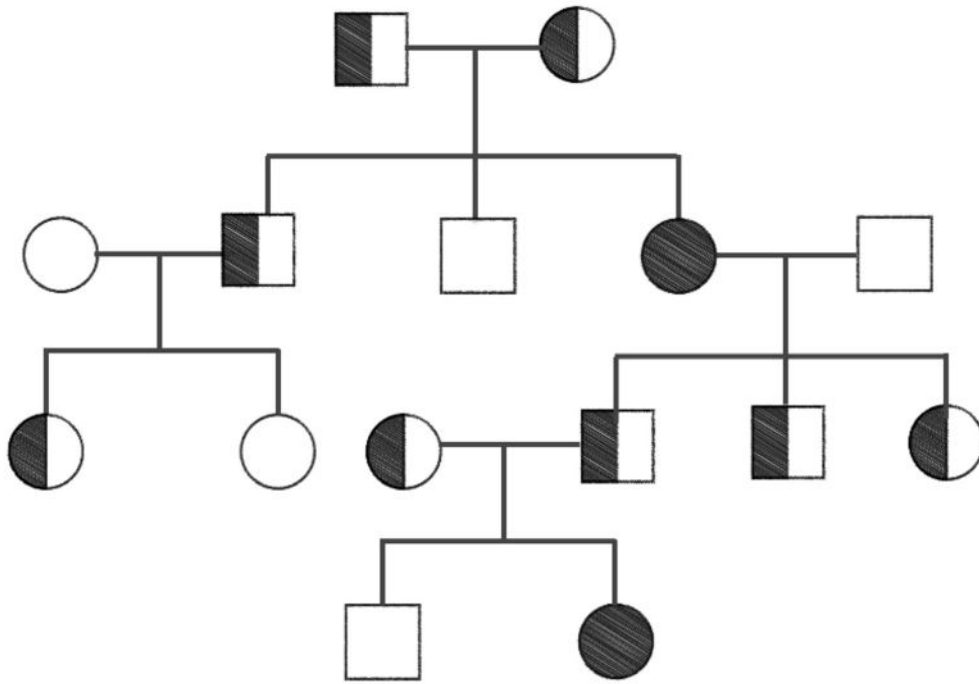
EXTENSION

Have students engage in the pedigree activity but include gene data after the video. Once students learn that half of the genetic material comes from mom and the other from dad, tell them that they can add that data to their pedigrees using letters. Tell students that in genetics, gene are represented by letters, for example, the capital letter H represents the gene for normal coloring and a lowercase h represents the gene for albinism. Every organism gets one gene (letter) from mom and the other gene (letter) from dad. Allow students to add the gene combination to each animal on the pedigree. If students get stuck, tell them to have albinism the animals must have the gene combination of aa.



STUDENT PEDIGREE ACTIVITY

Below is a pedigree for a family. Use the patterns you see in the model to answer the questions that follow the pedigree.



1. What patterns do you notice in this model?
2. What do you think the shapes that are only half shaded mean?
3. What does this model tell you about where albinism comes from?
4. What questions do you have now about albinism?